

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously presented) A method of updating values in a complex structured type column in a relational database system, comprising the steps of:
 - representing modifications to values in the complex structured type column using a data structure that aggregates changes to the values at arbitrary levels of a hierarchy of the complex structured column; and
 - computing the data structure in response to a data modification statement on the database to determine which values within the complex structured type column to update with the aggregated changes.
2. (Previously presented) The method as in claim 1, comprising the further step of simultaneously updating multiple scalar values at different levels within the hierarchy of the complex structured type column.
3. (Previously presented) The method as in claim 1, comprising the further step of simultaneously updating a scalar value in a table along with a complex structured type value in a complex structured type column of said relational database system.
4. (Previously presented) The method as in claim 1, comprising the further step of embedding an INSERT/UPDATE/DELETE statement inside a SET clause of an UPDATE statement.
5. (Previously presented) The method as in claim 4, comprising the further step of embedding a plurality of nested SET clauses inside an outer-most UPDATE statement corresponding to each layer within the hierarchy of the complex structured type column.
6. (Previously presented) The method as in claim 4, wherein the computing step comprises the steps of updating only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updating only those

rows of the index that correspond to the actual values that are modified by the UPDATE statement.

7. (Previously presented) The method as in claim 1, comprising the further step of applying the aggregated changes to the complex structured type column, wherein the applying step is separate from the computing step so as to provide Halloween Protection.

8. (Previously presented) A relational database system responsive to database modification statements to store and update values in at least one complex structured type column, comprising:

a parser that parses a database modification statement and produces a description of changes to the database proposed by the database modification statement;

a query optimizer that produces an execution algorithm to implement the database modification statement; and

a query execution engine that uses the execution algorithm to compute a data structure of the database modification statement to determine which values within a complex structured type column are to be updated, wherein the data structure represents values in the complex structured type column as an aggregation of changes to the values at arbitrary levels of a hierarchy of the complex structured type column, and said query execution engine applies the changes to the values in the complex structured type column that are to be updated.

9. (Previously presented) The system as in claim 8, wherein the query execution engine simultaneously updates multiple scalar values at different levels within the hierarchy of the complex structured type column.

10. (Previously presented) The system as in claim 8, wherein the query execution engine simultaneously updates a scalar value in a table along with a complex structured type value in a complex structured type column of said relational database system.

11. (Previously presented) The system as in claim 8, wherein the parser parses a SET clause of a database UPDATE statement.

12. (Previously presented) The system as in claim 11, wherein the parser parses the UPDATE statement in a plurality of nested SET clauses inside an outermost UPDATE statement corresponding to each level within the hierarchy of the complex structured type column.

13. (Previously presented) The system as in claim 11, wherein the query execution engine updates only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updates only those rows of the index that correspond to the actual values that are modified by the UPDATE statement.

14. (Previously presented) The system as in claim 8, wherein the query execution engine applies the aggregated changes to the complex structured type column separate from the computation of the data structure so as to provide Halloween Protection.

15. (Previously presented) A method of updating values in a collection-valued column in a relational database system, comprising the steps of:

representing modifications to values in the collection-valued column using a data structure that aggregates changes to the values at arbitrary levels inside the collection-valued column; and

computing the data structure in response to a data modification statement on the database to determine which values within the collection-valued column to update with the aggregated changes.

16. (Previously presented) The method as in claim 15, comprising the further step of simultaneously updating multiple scalar values at different levels within the collection-valued column.

17. (Previously presented) The method as in claim 15, comprising the further step of simultaneously updating a scalar value in a table along with a value in a collection-valued column of said relational database system.

18. (Previously presented) A relational database system responsive to database modification statements to store and update values in at least one collection-valued column, comprising:

- a parser that parses a database modification statement and produces a description of changes to the database proposed by the database modification statement;

- a query optimizer that produces an execution algorithm to implement the database modification statement; and

- a query execution engine that uses the execution algorithm to compute a data structure of the database modification statement to determine which values within a collection-valued column are to be updated, wherein the data structure represents values in the collection-valued column as an aggregation of changes to the values at arbitrary levels inside the collection-valued column, and said query execution engine applies the changes to the values in the collection-valued column that are to be updated.

19. (Previously presented) The system as in claim 18, wherein the parser parses a SET clause of a database UPDATE statement.

20. (Previously presented) The system as in claim 19, wherein the parser parses the UPDATE statement in a plurality of nested SET clauses inside an outermost UPDATE statement corresponding to each level within the collection-valued column.

21. (Previously presented) The system as in claim 18, wherein the query execution engine updates only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updates only those rows of the index that correspond to the actual values that are modified by the UPDATE statement.

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22. (Previously presented) The system as in claim 18, wherein the query execution engine applies the aggregated changes to the collection-valued column separate from the computation of the data structure so as to provide Halloween Protection.